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ABSTRACT

This standards document begins with a brief introduction and overview outlining and explaining a vision for mathematics teaching and learning in South Dakota, the purpose of the document, and the structure/organization of the document. Goals, rationales, and indicators for South Dakota Mathematics are also listed along with the South Dakota Mathematics Standards for grades K-12. (ASK)

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SOUTH DAKOTA

MATHEMATICS

CONTENT STANDARDS

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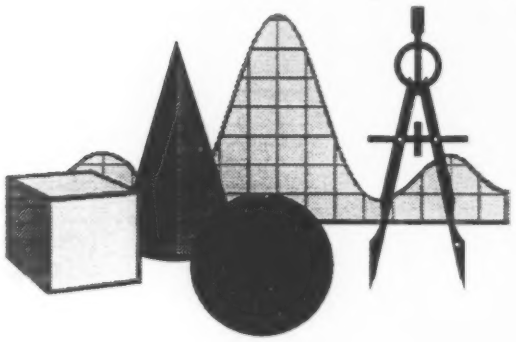

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December 15, 1998

SOUTH DAKOTA DEPARTMENT OF EDUCATION AND CULTURAL AFFAIRS

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SOUTH DAKOTA
MATHEMATICS STANDARDS DOCUMENT

INTRODUCTION/OVERVIEW

PREFACE

In 1997, the SD State Legislature passed SB 170 which amended South Dakota Codified Law 13-3-48 to address the issue of challenging state content standards. The adopted amendment read as follows: "The secretary of the Department of Education and Cultural Affairs shall prepare and submit for approval of the South Dakota Board of Education academic content standards in language arts, mathematics, social studies, and science for grades one through twelve. Each school district shall adopt and implement clearly defined and measurable course guidelines so as to meet the state academic content standards."

In accordance with SD Codified Law 13-3-48, this publication presents the SD Content Standards for K-12 Mathematics. The document builds upon the initial efforts of dedicated groups of K-16 educators who drafted the first mathematics benchmarks under the auspices of the National Science Foundation Statewide Systemic Initiative (NSF-SSI, 1992-1994) and the drafts which evolved during the federally funded South Dakota Initiative for Challenging Standards project (SDICS, 1994-1997). In the development of these standards, the writers researched and reviewed many respected and well-grounded national and state publications related to mathematics standards, instruction, and assessment. Included among these were the *Curriculum and Evaluation Standards for School Mathematics*, published by the National Council of Teachers of Mathematics.

After going through several drafts and a lengthy process of revision, which included comments and suggestions from educators, parents, and concerned citizens, these South Dakota K-12 Mathematics Standards were presented to the South Dakota State Board of Education for final review and were officially approved on December 15, 1998.

The standards document begins with this brief introduction and overview which outlines and explains a vision for mathematics teaching and learning in South Dakota, the purpose of the document, and the structure/organization of the document.

A VISION FOR MATHEMATICS IN SOUTH DAKOTA

Although the South Dakota Mathematics Standards provide common goals for K-12 mathematics, the "what" of the goals cannot be addressed without also considering the "how" of mathematics teaching and learning. The constantly changing, increasingly complex and technological world in which we live demands that the standards be addressed in positive, effective learning environments. The vision for these mathematical learning environments is evident in schools and classrooms which:

- actively involve all students in doing meaningful mathematics through a variety of challenging and attainable tasks
- emphasize the teaching of deeper understanding of mathematics through a problem-solving approach
- include the use of manipulatives, concrete materials, representations, and real-life applications in all grades, K-12
- build a strong "thinking and doing" foundation which provides mathematical understanding in three ways: numerically, geometrically, and algebraically

- build a strong "thinking and doing" foundation which provides mathematical understanding in three ways: numerically, geometrically, and algebraically
- provide opportunities for students to engage in mathematical dialogue and discussion, both with peers and adults
- require the use of variety of technological tools (e.g., calculators, computers, mathematical and scientific software programs)
- are rigorous enough to assist all students in achieving the mathematical literacy needed to be globally competitive

THE PURPOSE OF THE SOUTH DAKOTA STANDARDS DOCUMENT

The South Dakota Standards serves many purposes. They provide an essential core of content in mathematics to be taught and learned in each grade level. Its organization and presentation is meant to promote shared responsibility and accountability for all educational stakeholders in South Dakota by providing a clear understanding of the expectations for all students at each grade level. It is meant to provide a starting point for informed dialogue among those dedicated and committed to quality education in South Dakota: parents, teachers, administrators, board members, and community members. By providing a common set of goals and expectations for all students in all schools, this education dialogue will be strengthened and enhanced.

THE ORGANIZATION OF THE SD MATHEMATICS STANDARDS

The SD Mathematics Standards document outlines six major areas of the mathematics discipline and the grade level standards associated with each goal. It is organized by each separate grade level so that a parent, local school board member, classroom teacher, or administrator could quickly review what mathematical learning is expected at that grade level.

The grade level standards represent the classroom learning objectives or activities which should be provided at each grade. These are presented in single grade levels except at grades 9-12. Currently, in South Dakota, administrative rule requires that high school students take at least a minimum of two units (years) of mathematics to graduate, but does not mandate the specific "courses" that all students must have. It is the responsibility of each school district to "organize" the 9-12 grade level standards into the courses they offer at the 9-12 level.

CONCLUSION

The National Council of Teachers of Mathematics, in the *Curriculum and Evaluation Standards for Mathematics*, stated that "historically there have been three reasons for groups to formally adopt a set of standards: (1) to ensure quality, (2) to indicate goals, and (3) to promote change. For NCTM, all three reasons are of equal importance." These same premises hold true for the South Dakota Mathematics Standards. It is hoped that these standards will be used (1) to assure quality mathematics learning experiences for all children, (2) to communicate common goals for mathematics education to students, parents, educators, and communities, and (3) to support meaningful, on-going professional development which promotes thoughtful, positive, and effective changes in mathematics instruction and assessment. The ultimate purpose of the standards is to ensure that **all students** have the opportunity to acquire the mathematical literacy needed to be successful in the technological, globally-competitive world of the twenty-first century.

Goals

1. **Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.**

2. **Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.**

3. **Students will apply systems of measurement and use appropriate measurement tools to describe and analyze the world around them.**

4. **Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.**

5. **Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.**

6. **Students will apply statistical methods to analyze data and explore probability for making decisions and predictions.**

Goals and Rationales

In this 1998 South Dakota Content Standards document, the format has been organized into six overall K-12 goals which represent the discipline of mathematics. Each of the six goals is listed below, accompanied by a rationale. The rationales are brief descriptions of the goal and its importance for our students as they prepare for adulthood.

GOAL 1: ALGEBRA

Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

RATIONALE:

Algebra is a language of mathematics based on symbols used to communicate concepts, relationships, and abstract ideas. Algebra is a tool that is used to model real situations and answer questions about situations. This often leads to the development of concepts at an abstract level. The changing role of technology and societal needs requires that more emphasis be placed on algebraic thinking, generalizations, and algebra as a problem solving tool and less emphasis on the manipulation of symbols. The use of alebra begins in the primary grades and should be sequentially developed throughout the elementary, middle, and secondary grades.

GOAL 2: GEOMETRY

Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.

RATIONALE:

Geometry is a language of mathematics that is used to communicate the properties of and relationships between objects. Experiences related to the recognition, visualization, representation, and transformation of geometric shapes and their properties from real-life experiences long before they computed. Mathematicians continue this process today as powerful models of our world are developed. Students spatial capabilities often exceed their numerical skills and tapping these strengths can improve number understandings and skills as well as pique as interest in mathematics. Geometry is connected to every strand in the mathematics curriculum and therefore should not be restricted to a formal deductive study.

GOAL 3: MEASUREMENT

Students will apply systems of measurement and use appropriate measurement tools to describe and analyze the world around them.

RATIONALE:

Measurement is a dimension, quantity, or capacity determined by comparison to a standard unit. The study of measurement provides useful and practical applications of mathematics and involves making connections within mathematics and across the curriculum. Students develop their understanding of measurement and systems of measurement through experiences that enable them to use a variety of techniques, tools, and units of measurement to describe, analyze, and answer quantifiable questions and phenomena.

GOAL 4: NUMBER SENSE

Students will develop and use number sense to investigate the characteristics and relationships of numbers in a variety of forms and modes of operations.

RATIONALE:

Number sense is the ability to interpret and use numbers in counting and measurement situations and to sense the reasonableness of results. Numbers are an important part of daily lives. We use numbers every day; therefore, it is important to understand the many kinds and uses of numbers. Number sense is "common sense" about numbers. A person's ability to perform numerical calculations does not guarantee the acquisition of number sense. Number sense is gained through opportunities to explore number relationships and opportunities to make decisions regarding strategies to follow in solving problems.

GOAL 5: PATTERN, RELATIONS, and FUNCTIONS

Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.

RATIONALE:

The study of patterns, relations, and functions help learners to recognize and generalize patterns and to identify and clarify functional relationships. A pattern is an arrangement of objects or symbols in which relationships can be established. A relationship is a correspondence between two values and a function is a relation in which the first value has exactly one second value. Students who are able to identify and classify patterns and funcitonal relationships are prepared to use pattern-based thinking to understand and represent mathematical and other real-world phenomena both in and out of school.

GOAL 6: STATISTICS and PROBABILITY

Students will apply statistical methods to analyze data and explore probability in making decisions and predictions.

RATIONALE:

Statistics is a mathematical tool used to analyze data. Collected data are processed and the interpretations of the data become translated into usable knowledge as decisions are based upon the interpretations. Probability is the mathematics of chance and the study of random events. Statistics is closely linked to probability as statistical data are often used to predict the likelihood of outcomes or future events. Understanding statistics and probability is essential in the modern world as consumers of print and electronic media must be able to judge the meaningfulness and appropriateness of the information presented and interpreted in the media.

Goals and Indicators

1. **Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.**

Indicators:

- Analyze procedures to transform algebraic expressions.
- Use a variety of algebraic concepts and methods to solve problems.
- Analyze and describe situations that involve one or more variables.

2. **Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.**

Indicators:

- Apply deductive and inductive reasoning to analyze geometic properties to solve problems.
- Analyze geometric figures from a variety of perspectives.

3. **Students will apply systems of measurement and use appropriate measurement tools to describe and analyze the world around them.**

Indicators:

- Use various units of measure within a system of measurement.
- Apply measurement concepts in practical applications.

4. **Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.**

Indicators:

- Analyze the structural characteristics of the real number system and its various subsystems.
- Apply number operations with real numbers and other number systems.
- Develop conjectures, predictions, or estimations to solve problems and verify or justify the results.
- Analyze the concepts of value, magnitude, and relative magnitude of real numbers.

5. **Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.**

Indicators:

- Analyze and describe the properties and behaviors of relations, functions, and their inverses.
- Apply relations and functions to complex problem solving situations.
- Analyze the applications of the concept of mathematical limit.

6. **Students will apply statistical methods to analyze data and explore probability for making decisions and predictions.**

Indicators:

- Use various statistical models to gather data, study problems, and draw conclusions.
- Apply the laws of probability to predict events/outcomes and solve problems.

SOUTH DAKOTA MATHEMATICS STANDARDS
KINDERGARTEN

By the end of kindergarten, students understand the consistency of small numbers, quantities and shapes in their everyday environment. They count, compare, describe, and sort objects, and develop a sense about properties and patterns, including probability and statistics.

KINDERGARTEN ALGEBRA STANDARDS

THE STUDENT WILL:

1. compare collections of objects to determine more, less, and equal.
2. recognize and create a variety of sets and patterns using symbols.
3. recognize that addition or subtraction is used to solve problems.
4. recognize and explain + and - symbols.
5. use symbols to represent known and unknown quantities.
6. use informal methods to solve everyday problems.
7. explore and model possible addition and subtraction combinations for a given number.

KINDERGARTEN GEOMETRY STANDARDS

THE STUDENT WILL:

1. identify and draw plane geometric figures. (example: square, rectangle, circle, triangle)
2. identify and describe solid figures. (example: cube and sphere)
3. compare and sort plane figures based on observable attributes.
4. identify and describe geometric objects in the environment and describe their position. (example: such as next to, top, bottom)
5. explore various geometic patterns.

KINDERGARTEN MEASUREMENT STANDARDS

THE STUDENT WILL:

1. identify coins and their value. (example: penny, nickel, dime)
2. explore and compare orientation in time. (example: yesterday, today, tomorrow, days, hours, minutes, weeks, months, years, seasons)
3. explore length, weight, and volume of objects using standard and non-standard units.
4. order a group of objects by measurable attributes.
5. explore various tools used in measurements.
6. compare objects or events using direct comparison according to a given attribute. (example: length (longer/shorter), height (taller/shorter), volume (holds more/holds less)
7. compare temperatures of different objects. (example: hot water, cold water, ice cubes)

KINDERGARTEN NUMBER SENSE STANDARDS

THE STUDENT WILL:

1. count and group numbers, objects, and simple events.
2. recognize patterns from counting by number groups, using concrete objects and a calculator. (example: 2s, 5s, 10s)
3. represent numbers through the use of physical models, word names, and symbols.
4. identify ordinal positions of objects in a set. (example: 1^{st}, 2^{nd}, 3^{rd})
5. use objects to model addition and subtraction.
6. determine the number of objects in a set when one object is added or subtracted.
7. demonstrate and describe that a whole is composed of fractional parts using things encountered in daily experiences.
8. represent problem situations using concrete objects.
9. estimate answers to problems using comparative words. (example: greater, fewer, more, less)
10. explain how to solve story and picture problems.
11. explore place value by grouping objects by tens and ones.
12. order a set of numbers based on value.
13. use relationship vocabulary to describe value and magnitude of objects. (example: bigger, smaller, more, less, same, equal)

KINDERGARTEN PATTERNS, RELATIONS, AND FUNCTIONS STANDARDS

THE STUDENT WILL:

1. sort and classify objects according to similar attributes. (example: size, shape, or color)
2. identify common attributes found in different groupings.
3. explore effects of change on a pattern.
4. identify and extend repeating patterns found in common objects, sounds, and movements.
5. create repeating patterns.
6. identify potential arrangements/combinations for sets of three objects.

KINDERGARTEN STATISTICS & PROBABILITY STANDARDS

THE STUDENT WILL:

1. describe ways to sort and/or group given sets of objects or data.
2. collect and record information using tallies, picture graphs, or other strategies.
3. describe and compare observable quantities of collected data. (example: the flavor of ice cream most people liked)
4. explore chance using game situations and spinners.
5. explore the concept of probability through the use of chance events. (example: coin toss, dice, spinners)

SOUTH DAKOTA MATHEMATICS STANDARDS
GRADE 1

By the end of first grade, students can use the concepts of "ones" and "tens" in the place value number system. They can add and subtract small numbers with ease. They measure a variety of objects with simple units and use geometric concepts to describe their world. They can collect and organize data, describe simple probability situations, and analyze and solve basic problem situations.

FIRST GRADE ALGEBRA STANDARDS

THE STUDENT WILL:

1. use the concepts of equal to, greater than, and less than to compare numbers and sets.
2. extend a variety of patterns and generalize relationships using symbols and objects.
3. identify number sentences that represent the commutative property of addition.
4. use +, -, and = symbols to write number sentences and solve problems.
5. understand that symbols can be used to represent unknown quantities in mathematical sentences.
6. describe problem situations that require addition.
7. describe problem situations that require subtraction.
8. use informal methods to solve everyday problems requiring more than one operation.
9. given sets of objects, determine all the ways to divide a set of objects into equal groups.
10. determine all possible addition and subtraction combinations for a given number.

FIRST GRADE GEOMETRY STANDARDS

THE STUDENT WILL:

1. identify, describe, and draw plane figures according to number of sides, corners, and square corners. (example: octagon, pentagon, hexagon, polygon, trapezoid)
2. identify and describe solid figures including cubes, cylinders, pyramids, and spheres.
3. identify and describe examples of plane and solid figures in the environment.
4. describe proximity of objects in space. (example: near, far, up, down, below, beside)
5. explore concepts of perspective. (example: side, front, back)
6. determine ways in which shapes can be divided into equal pieces.

FIRST GRADE MEASUREMENT STANDARDS

THE STUDENT WILL:

1. measure time to the nearest quarter hour, half hour, and hour.
2. use specific units of measure to explore length, weight, volume, and temperature.
3. count and trade objects to explore the concept of equivalence. (example: how many nickels equal a quarter)
4. compare and order a group of objects by measurable attributes.
5. identify various tools used to solve measurement problems.
6. read scales of length, weight, and temperature for measurement.
7. observe and record temperatures taken at various times.
8. explore the concept of area and perimeter using squares, counting cubes, or base-ten blocks.

FIRST GRADE NUMBER SENSE STANDARDS

THE STUDENT WILL:

1. count by number groups. (example: 2s, 3s, 5s, 10s)
2. count objects in a given set and write the corresponding numeral.
3. identify ordinal positions using an ordered set of objects, 1st through 20th.
4. classify and model numbers as even or odd.
5. recall basic addition and subtraction facts through the 9s.
6. select the appropriate operation to solve specific problems involving whole numbers.
7. use fraction models to identify parts of a whole and parts of a group.
8. estimate and find the sum or difference of two whole numbers written in horizontal or vertical form.
9. explore problem situations using concrete materials, drawings, or words.
10. explain or justify estimates to everyday quantity problems. (example: how many jelly beans may be in the jar)
11. explain how one arrives at solutions to problems.
12. use words, models, and expanded notation to represent two-digit numbers.
13. order and compare whole numbers up to 100.
14. compare and order common fractions using concrete materials. (example: one-fourth to one-half of a cookie)

FIRST GRADE PATTERNS, RELATIONS, AND FUNCTIONS STANDARDS

THE STUDENT WILL:

1. sort and classify objects according to one or more attributes. (example: color, size, shape, or thickness)
2. identify like and unlike attributes of objects in a given group.
3. recognize and extend basic number patterns using different forms of a hundreds chart.
4. describe or demonstrate the next element in repeating patterns. (example: rhythm, color, shape, and number patterns)
5. find patterns or relations in data organized in tables or charts to determine what should come next.
6. explain ways to change an arrangement of objects.
7. explore the concept of discrete patterns. (example: money)

FIRST GRADE STATISTICS & PROBABILITY STANDARDS

THE STUDENT WILL:

1. gather and record data from various sources or situations including surveys and simple experiments.
2. organize data into tally charts, picture graphs, and bar graphs.
3. describe represented data in terms of most often, least often, and range.
4. use concept of chance to explore probability of actual events.
5. predict possible outcomes of probability experiments. (example: tossing a die or a coin)
6. generate data from probability experiments using spinners, tiles, or dice.
7. explain how some events are more likely to occur than others.

SOUTH DAKOTA MATHEMATICS STANDARDS
GRADE 2

By the end of second grade, students understand place value and number relationships as they add and subtract. They have developed a foundation for understanding fractions and multiplication. They measure quantities with appropriate tools and units. They have an understanding of shapes and the elements that comprise the plane and solid figures. In addition, they can describe patterns and relationships. They can collect and analyze data and explain simple chance situations.

SECOND GRADE ALGEBRA STANDARDS

THE STUDENT WILL:

1. identify number sentences that represent the inverse operation of given number sentences.
2. apply the addition properties of zero and one in problem situations.
3. describe the inverse relationship between addition and subtraction, write related equations, and solve. (example: 3+5 = 8, 8-5=3, 35 + _ = 47, 47 - 35 = _)
4. describe techniques used in adding and subtracting numbers. (example: 7 + 3 is the same as 5 + 3 + 2 and 18 + 8 is the same as18 + 2 + 6)
5. identify relevant and irrelevant information in the statements of problem situations.
6. identify problem situations that match or do not match a given number sentence.
7. solve addition and subtraction problems using numberlines.
8. use informal methods to solve everyday problems requiring open sentences with one unknown.
9. use properties of addition and subtraction to devise algorithms (rule) or check results.
10. solve addition and subtraction problems using data from simple charts, picture graphs, and number sentences. (example: find the answer for 4 + X = ? when X = 2)

SECOND GRADE GEOMETRY STANDARDS

THE STUDENT WILL:

1. identify and describe solid figures according to faces, edges, bases, and corners.
2. classify plane figures using sides and vertices.
3. compare plane and solid figures. (example: circle/sphere, square/cube, triangle/pyramid, rectangle/rectangular solid)
4. compare plane figures to determine if objects are similar or congruent.
5. identify geometric figures regardless of position and orientation in space.
6. use objects to perform geometric transformations including flips, slides, and turns.
7. identify lines of symmetry in a variety of shapes and figures.

SECOND GRADE MEASUREMENT STANDARDS

THE STUDENT WILL:

1. measure time to the nearest five minute interval.
2. order events by time sequence; past, future, and equivalent periods of time.
3. use $, cent symbol, and decimal point appropriately when working with money.

4. select an appropriate standard or non-standard unit to measure various objects and substances.
5. predict whether the measure will be greater or smaller when a different unit is used. (example: 3 dimes > a quarter)
6. use appropriate tools and units of measure to solve problems.
7. use scales of length, weight, and volume within a measurement system.
8. record and compare various measurement situations. (example: temperature to the nearest degree, precipitation to the nearest inch)
9. estimate and determine the area, perimeter, and volume of figures by covering them with squares, counting cubes, or base ten blocks.

SECOND GRADE NUMBER SENSE STANDARDS

THE STUDENT WILL:

1. count by number groups to 1000 or higher. (example: 3s, 4s, 5s, 10s, 20s)
2. associate verbal names, written word names, and standard numerals with whole numbers less than 1000.
3. identify ordinal positions using ordered sets of objects.
4. explain concept of even and odd numbers.
5. explore the concept of mixed numbers.
6. solve two- and three-digit addition and subtraction problems.
7. estimate sums and/or differences of two whole numbers and find the answers using the appropriate methods of computing.
8. use models to explore addition and subtraction of fractions.
9. identify the correct usage of decimal point for decimals and money.
10. model problem situations in a variety of ways. (example: concrete materials, tables, charts, drawings, words)
11. estimate sums and differences of whole numbers and determine if a given estimate is correct.
12. solve story problems involving multi-step operations.
13. explain the strategies used to arrive at a solution to a problem.
14. use words, models, and expanded notation to represent numbers with two or more digits.
15. compare and order fractions and decimals on a number line.
16. understand relative size of whole numbers.
17. recognize relationships between common decimals and fractions. (example: ½ = 0.5)

SECOND GRADE PATTERNS, RELATIONS, AND FUNCTIONS STANDARDS

THE STUDENT WILL:

1. determine common attributes in a given group and identify those objects that do not belong.
2. use data to explain relationships. (example: plants grow taller with more hours of sunlight)
3. explain relationships present in a given set of data.
4. find patterns and relationships in sequences of numbers. (example: doubles in learning addition; given three numbers, find the next number in the sequence)
5. write and solve number sentences from problem situations that express relationships.
6. describe and represent patterns that are growing and/or repeating.
7. represent patterns geometrically and numerically.
8. identify examples of continuous patterns.
9. identify examples of discrete patterns. (example: seasons, days of the week)

10. explore bounded relationships. (example: what is the largest possible sum of any two numbers from given set)

SECOND GRADE STATISTICS & PROBABILITY STANDARDS

THE STUDENT WILL:

1. represent data sets in more than one way. (example: charts, line graphs, bar graphs)
2. identify features of data sets. (example: range, median, and mode)
3. determine if data collected is relevant and/or appropriate.
4. form questions about and generate explanations of data given in tables and graphs.
5. use concepts of chance and certainty to discuss the probability of actual events.
6. list all possible outcomes of probability experiments.
7. determine if common events are certain, likely, unlikely, or impossible.
8. use spinners, tiles, and dice to predict which event is more likely to occur if an experiment is repeated.

SOUTH DAKOTA MATHEMATICS STANDARDS
GRADE 3

By the end of third grade, students have deepened their understanding of place value and their understanding of and skill with addition, subtraction, multiplication and division of whole numbers. They can estimate and measure using a variety of tools and units. They can describe objects in space. They use patterns and their understanding of computation to solve a wide variety of problems. They can collect, organize, and analyze data along with conduct and analyze simple probability experiments.

THIRD GRADE ALGEBRA STANDARDS

THE STUDENT WILL:

1. solve problems involving numeric equations or inequalities.
2. explain the relationship between repeated addition and multiplication.
3. recognize and use the commutative and associative properties of multiplication. (example: if $6 \times 7 = 42$, then what is 7×6?)
4. use appropriate terms in mathematical explanations. (example: multiple, factor, product)
5. identify special properties of 0 and 1 with respect to arithmetic operations.
6. represent given problem situations using diagrams, models, and symbolic expressions.
7. select appropriate operational and relational symbols to make expressions true. (example: 4 _ 3 = 12)
8. use concrete materials to model and solve equations.
9. explain the relationship between multiplication and division to compute and check results. (example: 3 x 7 = 21, so 21 ÷ 7 = _)
10. determine various multiplication and division sentences for a given number.
11. investigate and describe the concept of variable (unknown quantity). (example: $3 + z = 5$)

THIRD GRADE GEOMETRY STANDARDS

THE STUDENT WILL:

1. analyze and classify plane and solid geometric figures using relevant properties. (example: number of corners, square corners, shape of faces, and edges)
2. identify and draw representations of line segments and angles using rulers or straightedges.
3. use geometric properties (length, width, perimeter) of two-dimensional shapes to solve problems.
4. predict, illustrate, and verify which figures could result from a flip, slide, or turn of a given figure.
5. demonstrate relationships between and among figures using symmetry, similarity, and congruence.
6. rearrange geometric parts of a given figure to create new patterns.

THIRD GRADE MEASUREMENT STANDARDS

THE STUDENT WILL:

1. measure time within fractions of a second. (example: stop watch)
2. describe time using the concepts of how long until, the duration of an event, and equivalent periods.

3. count, compare, make change, and solve problems using a collection of coins and bills.
4. explore unit relationships within a system of measurement. (example: four quarts = a gallon)
5. determine the appropriate tools and units of measure for problem solving.
6. estimate and measure length to the nearest $\frac{1}{4}$ inch or the nearest centimeter.
7. measure and compare objects using measurable attributes.
8. estimate and measure perimeter, area, and volume of irregular objects.

THIRD GRADE NUMBER SENSE STANDARDS

THE STUDENT WILL:

1. explore basic number theory concepts with whole numbers. (example: primes, composites, factors, multiples)
2. name, represent, and write fractions and decimals.
3. demonstrate that a mixed number is a whole number plus a fraction.
4. add and subtract multi-digit whole numbers using various computational methods.
5. recall multiplication and division facts through the nines.
6. add and subtract with fractions and decimals.
7. solve problems using addition, subtraction, and multiplication.
8. use estimation in problems with whole numbers.
9. identify similarities within different problem-solving situations involving addition and subtraction. (example: There are nine seats in a van and five persons in my family, how many open seats do I have?)
10. order and compare whole numbers using appropriate words and symbols. (example: $<$, greater than)
11. compare numerical value of fractions having like and unlike denominators.
12. compare decimals expressed as tenths and hundredths.
13. recognize that fractions and decimals are parts of a whole.

THIRD GRADE PATTERNS, RELATIONS, AND FUNCTIONS STANDARDS

THE STUDENT WILL:

1. investigate the concept of a variable (unknown quantity).
2. determine total costs as a function of the number of units and the per unit cost.
3. use number patterns and relationships to learn basic facts. (example: nines tables)
4. solve problems involving a function relationship and graph the resulting ordered pairs of whole numbers on a grid. (example: height, age)
5. extend linear patterns by their rules. (example: the number of legs on *n* horses can be calculated by counting by fours)
6. explain ways to change an arrangement of objects.
7. explore discrete (months of the year) and continuous patterns.

THIRD GRADE STATISTICS & PROBABILITY STANDARDS

THE STUDENT WILL:

1. represent data in line plots, bar graphs, tables, or tally charts using appropriate form and scales for the data.
2. determine range and mode(s) of sets of data.
3. ask and answer relevant questions from data represented in charts, tables, and graphs.
4. explore possible arrangements of a limited number of objects. (example: How many ways can a blue, a red, and a green block be lined up?)
5. explore what happens to results when data is pooled. (example: each person contributes their results to a class data set)
6. use results of probability experiments to make predictions about future events.
7. describe events that are certain or impossible.

SOUTH DAKOTA MATHEMATICS STANDARDS
GRADE 4

By the end of fourth grade, students understand large numbers and addition, subtraction, multiplication, and division of whole numbers. They can describe, compare, and do basic computation with fractions and decimals. They understand the properties of and relationships between plane and solid geometric figures. They can use patterns and basic algebraic thinking to solve a variety of problems. They can collect, represent, and analyze data to answer questions.

FOURTH GRADE ALGEBRA STANDARDS

THE STUDENT WILL:

1. relate the concepts of addition, subtraction, multiplication, and division to one another. (example: use of the associative, commutative, and distributive properties)
2. use appropriate terms in mathematical explanations. (example: divisor, dividend, quotient)
3. explore how to simplify numerical expressions involving addition, subtraction, multiplication, division, and parentheses.
4. create mathematical sentences that are true using three given numbers.
5. use tables to model and solve equations.
6. use the number line as a method to solve problems.
7. describe given problem situations in multiple ways.
8. use variables as place holders in number sentences. (example: $m + w = 6$; $3 \times K = 12$)
9. write and solve number sentences that represent word problems.
10. use multiple methods to solve real-world problems involving equations and inequalities. (example: physical models and graphs)
11. explain the process used to simplify a three-step problem.
12. use models to explain how changing one variable causes a change in another. (example: area, perimeter)

FOURTH GRADE GEOMETRY STANDARDS

THE STUDENT WILL:

1. investigate, describe, and identify the relationships between and among points, lines, line segments, and rays.
2. determine if sides of plane figures, faces of solid objects, or edges of solid objects are the same size, parallel, or perpendicular.
3. use appropriate geometric language to write descriptions of figures or pictures composed of geometric figures.
4. apply a variety of strategies and geometric properties of two- dimensional shapes to solve problems.
5. analyze geometric figures using size, shape, orientation, congruence, and similarity.
6. interpret or create scales on maps and drawings.
7. visualize and represent two-dimensional views of three-dimensional objects which are made from rectangular solids.
8. combine or take apart three-dimensional solids to construct new objects.

FOURTH GRADE MEASUREMENT STANDARDS

THE STUDENT WILL:

1. measure time using fractions. (example: fractions of an hour, fractions of a year)
2. solve problems involving money. (example: use of proper notation, unit conversions, and making change)
3. select and use the most appropriate units for given measurement situations.
4. carry out unit conversions within a system of measurement. (example: inches, feet, yards)
5. explore the use of formulas that assist in measurement situations. (example: area)
6. use scales of length, temperature, volume, and weight for problem solving.
7. measure length to the nearest eighth inch or to the nearest millimeter.
8. estimate and measure liquid volume in a variety of ways. (example: cups, pints, quarts, gallons, milliliters, liters)
9. develop strategies to make measurement estimates.

FOURTH GRADE NUMBER SENSE STANDARDS

THE STUDENT WILL:

1. find multiples and factors of numbers to 400.
2. identify and explain the meaning of square numbers and cube numbers.
3. interpret negative integers. (example: temperature, number line)
4. demonstrate that the value of a fraction is not changed when the numerator and denominator are multiplied by the same number.
5. apply multiplication and division facts through the 12s.
6. find the products of multi-digit factors.
7. find the quotient of two whole numbers.
8. use the four operations with fractions and decimals.
9. solve addition and subtraction problems using negative numbers.
10. use and justify estimations in problems with whole numbers, fractions, decimals, and money.
11. identify the appropriate arithmetic operations in multi-step problem situations.
12. identify similarities within different problem-solving situations involving multiplication and division.
13. use a number line to compare numerical value of fractions or mixed numbers.
14. read, write, order, and compare numbers from .001 to over 1,000,000.
15. associate verbal names, written word names, and the appropriate symbols in mathematical sentences.
16. describe the relative size of large numbers using various models and/or everyday representations.
17. use and interpret negative numbers in simple contexts.

FOURTH GRADE PATTERNS, RELATIONS, AND FUNCTIONS STANDARDS

THE STUDENT WILL:

1. describe the concept of a variable (unknown quantity).
2. use the understanding that an equality relationship between two quantities remains the same as long as the same change is made to both quantities.
3. determine per unit cost based on number of units and the total cost.
4. solve problems involving pattern identification and completion of patterns.
5. describe a rule for simple patterns.
6. analyze given patterns formed using concrete objects and pictures in order to create patterns with the same attributes.
7. determine all combinations or arrangements of a limited number of objects.
8. explain if there is a limit to what can be done in a given situation. (example: sharing 10 candy bars among 20 people. What is the maximum amount a given person could have?)

FOURTH GRADE STATISTICS & PROBABILITY STANDARDS

THE STUDENT WILL:

1. develop survey questions and systematically collect appropriate data.
2. use appropriate scales to represent data in various forms.
3. interpret and analyze data from graphical representations and draw justifiable conclusions.
4. use mode, mean, median, and range to describe results and support predictions.
5. predict and represent possible outcomes for a simple probability situation in an organized manner. (example: tables, grids, tree diagrams)
6. analyze outcomes of probability for both individual and group experiments and report the results.
7. explain why unlikely events may occur fairly often in very large samples.
8. determine the probability of simple events using a variety of materials. (example: coins, spinners, dice, computer programs)

SOUTH DAKOTA MATHEMATICS STANDARDS
GRADE 5

By the end of fifth grade, students have increased their ability to work the four basic arithmetic operations applied to whole numbers, fractions, decimals, and negative numbers. They can apply patterns, relations, and algebraic thinking to solve a wide variety of problems. They can use common measuring units and tools to determine length, area, mass, and volume. They know and use formulas to determine area, perimeter, and volume of basic geometric shapes. They use a variety of strategies to record and analyze data and to determine the probability of simple events.

FIFTH GRADE ALGEBRA STANDARDS

THE STUDENT WILL:

1. demonstrate and explain use of associative, commutative, and distributive properties.
2. simplify numerical expressions involving addition, subtraction, multiplication, division, and parentheses. (example: $m = [3x(2-7)-8]$)
3. use variables, expressions, equations, and inequalities to solve problems.
4. create equivalent number sentences that use the inverse operation.
5. use information taken from a graph or equation to answer questions about a problem situation or create a "story".
6. solve one-step linear equations such as $2x = 10$, $x + 4 = 5$
7. use graphing techniques on a number line to model absolute value and arithmetic operations with integers.
8. analyze tables and graphs to identify properties and relationships.
9. represent situations and number patterns with concrete materials, tables, graphs, verbal rules, and algebraic notation.
10. interpret and use formulas to answer questions about quantities and their relationships. (example: $A = bh$)
11. use variables to represent given verbal quantities in problem situations.
12. solve open sentences using the four basic operations.

FIFTH GRADE GEOMETRY STANDARDS

THE STUDENT WILL:

1. use geometric properties and terms to describe, sort, and classify geometric objects.
2. state and use properties of squares, rectangles, isosceles and equilateral triangles, circles, and regular polygons to solve problems.
3. demonstrate that the ratio of the circumference to the diameter of a circle is constant.
4. represent and apply a variety of strategies and geometric properties and formulas for two- and three-dimensional shapes to solve problems.
5. create three-dimensional figures from two-dimensional drawings.
6. use two-dimensional coordinate grids to find locations and represent points and simple figures.
7. determine ways to transform images of objects.
8. recognize and describe bilateral and rotational symmetry in two- and three-dimensional figures. (example: mirror images, symmetry)

FIFTH GRADE MEASUREMENT STANDARDS

THE STUDENT WILL:

1. identify equivalent periods of time and solve problems. (example: relationships among days, months, and years; hours and minutes, A.M. and P.M.)
2. solve problems involving money. (example: use of proper notation, unit conversions, and making change)
3. use and convert measurement units. (example: inches to feet)
4. use formulas in measurement situations. (example: perimeter, area)
5. use degrees as a unit of measure for angles.
6. explain equivalent fractions in measurement.
7. use appropriate tools to measure length, weight, temperature, volume, and area.
8. develop strategies to estimate conversions between Fahrenheit and Celsius.
9. develop strategies to determine formulas used to find various measurements. (example: perimeter, area, or volume of objects)
10. solve measurement problems involving change in a measurable attribute.
11. use and evaluate strategies to make measurement estimates.

FIFTH GRADE NUMBER SENSE STANDARDS

THE STUDENT WILL:

1. apply basic number theory concepts to the rational number system.
2. represent numbers in a variety of equivalent forms.
3. use place-value concepts of grouping based upon powers of ten within the decimal number system.
4. write terminating decimals as fractions and explain why they represent the same value.
5. extend properties that work with positive numbers to negative numbers.
6. use the inverse relationship of multiplication and division to explain the effects of division.
7. determine least common multiple and greatest common factor of two or more whole numbers.
8. compute with rational numbers using the four arithmetic operations. (example: $\frac{1}{4} \div \frac{1}{2} = _$, $3.2 \times 1.5 = _$)
9. explain how the relationship between multiplication and division of whole numbers extends to the rational number system.
10. use and evaluate different estimation strategies to justify solutions for problems involving rational numbers.
11. determine reasonableness of calculations in problem situations.
12. select and use appropriate arithmetic operations for multi-step problem situations.
13. solve problems using non-routine strategies.
14. create and test rules that can be applied in unfamiliar problem-solving situations.
15. estimate, determine, and interpret the meaning of very large numbers. (example: "What day was it 10,000,000 seconds ago?")
16. read, write, and interpret whole number powers of 10. (example: $10^4 = 10{,}000$)
17. understand relative size of whole numbers, commonly used fractions, decimals, and percents.
18. read, write, order, and compare numbers from .0001 to over 1,000,000,000.
19. use the number line to compare the numerical value of rational numbers.

FIFTH GRADE PATTERNS, RELATIONS, AND FUNCTIONS STANDARDS

THE STUDENT WILL:

1. solve problems involving variables of speed, unit cost, or unit weight.
2. analyze how change in one variable causes a change in another. (example: holding area constant and changing length and width)
3. *write open sentences using variables to represent a given mathematical relationship.*
4. use a constant function to construct tables of input and output numbers and express the relationship as an open sentence.
5. describe and explain how one quantity determines another quantity in a functional relationship based on a linear pattern.
6. use information from a graph or equation to answer questions about a problem situation or to create a "story".
7. explain how there can be a bounded relation.
8. create examples of continuous patterns or functions.
9. create examples of discrete patterns or functions.

FIFTH GRADE STATISTICS & PROBABILITY STANDARDS

THE STUDENT WILL:

1. collect, organize, and display data in a variety of forms.
2. use statistical data about life situations to make predictions and justify reasoning.
3. analyze data to determine the appropriate uses of the measures of central tendency.
4. compare data sets of different sizes to determine reliability.
5. use models including tree diagrams to display possible outcomes and predict events.
6. classify probability of simple events as certain, likely, unlikely, or impossible.
7. explain how summary predictions about large collections of events are usually more accurate than summary predictions about just a few events.
8. use collected data to compare actual results to theoretical results such as a hundred coin tosses predicted results verses actual results in a fair coin toss.

SOUTH DAKOTA MATHEMATICS STANDARDS
GRADE 6

By the end of sixth grade, students have mastered the four arithmetic operations with positive and negative numbers, whole numbers, fractions and decimals; they accurately compute and solve problems. They apply their knowledge to statistics and probability. Students understand the concept of and how to calculate the range, mean, median and mode of data sets. They analyze data and sampling processes for possible bias and misleading conclusions, and they use addition and multiplication of fractions routinely to calculate probabilities for compound events. Students conceptually understand and work with ratios and proportions; they compute percentages (e.g., tax, tips, interest). Students know about *pi* and the formulas for the circumference and area of a circle. They use letters for numbers in formulas involving geometric shapes and in representing an unknown part of a ratio. They solve 1-step linear equations.

SIXTH GRADE ALGEBRA STANDARDS

THE STUDENT WILL:

1. use order of operations to solve problems.
2. explore various properties of equality and inequality.
3. explain the significance of the equal sign and inequality symbols in algebraic sentences.
4. write and solve one-step linear equations involving inverse operations, fractions, and decimals.
5. identify and graph ordered pairs in a coordinate plane.
6. analyze tables and graphs to identify relationships between variables in algebraic sentences.
7. use graphic forms to solve problems involving numerical relationships including inequalities.
8. use concrete materials and algebraic statements to represent problem situations.
9. solve problems involving rate of speed, unit cost, or unit weight.
10. use variables to represent given quantities in problem situations.

SIXTH GRADE GEOMETRY STANDARDS

THE STUDENT WILL:

1. identify, classify, and describe the characteristics of plane figures. (example: similarities and differences)
2. use given attributes to determine congruence of segments, angles, and polygons by direct comparison.
3. sketch, construct models, and classify rectangular prisms, cones, cylinders, and pyramids.
4. identify, describe, and classify angles.
5. explore problems involving regular and irregular shapes.
6. explore ways that shapes can be combined, subdivided, and changed using geometric concepts of symmetry, reflections, congruency, similarity, perpendicularity, and parallelism.
7. identify and plot ordered pairs in all four quadrants of the rectangular coordinate system.
8. explore ways to build three-dimensional figures from polygons.
9. develop two-dimensional representations that demonstrate various perspectives of three-dimensional objects.

SIXTH GRADE MEASUREMENT STANDARDS

THE STUDENT WILL:

1. use arbitrary referents to estimate and compare measurements. (example: nose to extended fingertip is approximately one yard)
2. convert units of measure within a measurement system.
3. explore the use of formulas that assist in measurement situations. (example: area)
4. select models of area that approximate referent values. (example: a sheet of paper is about one square foot)
5. use the most appropriate tool to measure length, temperature, and angle in customary and metric systems.
6. examine measurement situations to determine necessary degree of accuracy.
7. use area formulas to solve problems.
8. apply units or combinations of units for various measurement situations.

SIXTH GRADE NUMBER SENSE STANDARDS

THE STUDENT WILL:

1. represent numbers in a variety of equivalent forms. (example: fractions, decimals, percents)
2. use concepts about numbers to build number sequences. (example: primes, factors, multiples)
3. describe relationships among sets of rational numbers.
4. solve problems involving arithmetic operations with fractions and mixed numbers.
5. select appropriate operations to solve problems involving rational numbers, ratios, proportions, and percents.
6. model addition and subtraction with integers.
7. use estimation strategies to help solve multi-step problems involving rational numbers.
8. identify similarities within different problem solving situations.
9. create and justify rules that can be applied in unfamiliar problem-solving situations.
10. test new rules against proven procedures.
11. understand the magnitude of fractions, decimals, and percents.
12. associate mathematical symbols with word names for rational numbers.
13. explain the effects of operations on the magnitude of rational numbers.
14. identify, represent, compare, and order rational numbers and represent them on a number line.

SIXTH GRADE PATTERNS, RELATIONS, AND FUNCTIONS STANDARDS

THE STUDENT WILL:

1. explain functions using symbols and graphs.
2. recognize that rate is a measure of one quantity per unit value of another quantity.
3. solve simple problems involving rates, average speed, distance and time.
4. recognize, describe, and extend a variety of numeric and geometric patterns.
5. identify, describe, and generalize patterns involving multiples and perfect squares.
6. use tables and graphs to represent patterns found in real-world events. (example: month of birth)
7. apply maximums and minimums to various problem situations. (example: What is the maximum area that can be enclosed with a minimum amount of fencing?)

8. investigate the role of constants in determining relationships. (example: holding perimeter constant, What is the relationship to area?)
9. explore the concept of limit using various representations. (example: $\frac{1}{2}$ distance to the wall followed by another $\frac{1}{2}$ distance to the wall, . . .)

SIXTH GRADE STATISTICS & PROBABILITY STANDARDS

THE STUDENT WILL:

1. identify different ways to select samples and determine when to use sample data or population data.
2. compare and interpret mean, median, mode, and range.
3. analyze how data is displayed and its impact on conclusions reached.
4. use data to support or reject hypotheses.
5. represent all possible outcomes for compound events in an organized manner. (example: tables, tree diagrams)
6. identify probabilities of events and predict outcomes.
7. investigate and describe differences between probabilities of events found through simulation.
8. identify uses and misuses of probability theory in the everyday world.

SOUTH DAKOTA MATHEMATICS STANDARDS
GRADE 7

By the end of seventh grade students are adept at manipulating numbers and equations and understand the general principles at work. They understand and use factoring of numerator and denominators and properties of exponents. They know the Pythagorean Theorem and solve problems where they compute the length of an unknown side. Students know how to compute the surface area and volume of basic 3-D objects and understand how they change under a change in scale. Students convert between different units of measurement. They know and use different representations of fractional numbers (fractions, decimals, and percent) and are proficient at changing from one to another. They increase their facility with ratio and proportion and compute percentages of increase and decrease and simple compound interest. They graph linear functions and understand the idea of slope and its relation to ratio.

SEVENTH GRADE ALGEBRA STANDARDS

THE STUDENT WILL:

1. evaluate algebraic expressions for given replacement values of variables.
2. find and use generalizations about equalities and inequalities.
3. use associative, commutative, distributive and identity properties to create equivalent expressions.
4. explore linear equations to identify generalizations.
5. use graphs to solve problems including ordered pairs and inequalities.
6. solve one-step linear equations using strategies involving inverse operations and integers.
7. solve inequalities in one variable using strategies involving inverse operations and integers.
8. create algebraic statements representing patterns observed in life-related situations.
9. make predictions relating two variables using a rule or a graph.
10. use a scatterplot to determine line of best fit.

SEVENTH GRADE GEOMETRY STANDARDS

THE STUDENT WILL:

1. use deductive reasoning and inference to compare and contrast quadrilaterals.
2. identify, describe, and form polygons having up to ten sides.
3. identify and construct elements of geometric figures. (example: altitudes, midpoints, bisectors, radii, diameters, and chords)
4. use geometric properties, formulas, and relationships to solve problems involving regular and irregular shapes.
5. present logical arguments about the properties of basic geometric figures.
6. demonstrate ways that shapes can be combined, subdivided, and changed using transformations. (example: flips, slides, turns, and enlargements)
7. determine if geometric figures are similar and write proportions to express the relationships between corresponding parts of similar figures.
8. identify and construct two-dimensional patterns from three-dimensional models.

9. use the rectangular coordinate system to analyze connections between stretching, shrinking, and transforming figures.
10. explore and predict relationships within patterns. (example: tessellations)

SEVENTH GRADE MEASUREMENT STANDARDS

THE STUDENT WILL:

1. select, use, and explain methods for comparing measurements. (example: miles per hour to feet per second)
2. create scale drawings to represent real-world situations.
3. develop and use standard formulas for perimeter, area, and circumference.
4. use proportions to convert between units of measure.
5. use the most appropriate tool to measure mass, area, and angle in customary and metric systems.
6. analyze a variety of measurement situations to determine the necessary degree of accuracy and precision.
7. apply mathematical techniques to extend physical senses. (example: using shadows to determine height of tree)
8. estimate areas of irregular areas by subdividing them into rectangles and triangles.

SEVENTH GRADE NUMBER SENSE STANDARDS

THE STUDENT WILL:

1. represent numbers in a variety of equivalent forms. (example: integers, exponents, scientific notation)
2. find common multiples and factors. (example: least common multiple, greatest common factor)
3. explain the use of integers using examples from real-life situations.
4. describe and compare two sets of data using ratios including appropriate notation. (example: a:b, a/b, a to b)
5. add, subtract, multiply, and divide rational numbers.
6. solve consumer application problems involving discount, markup, commission, profit, and simple compound interest.
7. model multiplication and division with integers.
8. use estimation strategies to make predictions and help solve multi-step problems involving rational numbers.
9. develop and apply properties of proportions to solve problems.
10. formulate rules to solve practical problems involving integers.
11. analyze and apply properties of operations with rational numbers to simplify expressions.
12. understand the magnitude of integers and numbers expressed in scientific notation.
13. associate mathematical symbols with word names for irrational numbers.
14. explain the effects of operations on the magnitude of irrational numbers.
15. compare and order sets of numbers expressed in multiple forms.

SEVENTH GRADE PATTERNS, RELATIONS, AND FUNCTIONS STANDARDS

THE STUDENT WILL:

1. describe different ways in which variables are used.
2. model and solve multi-step problems involving rate, average speed, distance and time, or direct variation.
3. use graphs to distinguish between linear and nonlinear functions.
4. hypothesize relations or functions from patterns.
5. compute an "output" for a given "input" in a function.
6. identify, describe, and generalize patterns involving geometric growth, square roots, cubes, reciprocals, and exponents.
7. generalize numerical and geometric patterns using algebra and relate the equation, graph, and table of values for the generalization.
8. use tables and graphs to represent patterns found in real-world events. (example: temperature trends)
9. connect the concept of maximums and minimums to two- and three-dimensional representations.
10. identify examples of continuous functions.
11. identify examples of discrete functions.
12. model the concept of limit using various representations. (example: halving distances on the number line)

SEVENTH GRADE STATISTICS & PROBABILITY STANDARDS

THE STUDENT WILL:

1. explore the concept of sampling bias and describe procedures for selecting unbiased samples.
2. solve problems using mean, median, mode and range of a set of data.
3. display data, using frequency distributions, line plots, stem-and-leaf plots, box-and-whisker plots, and scattergrams.
4. make inferences and predictions based on the analysis of student collected data.
5. estimate probability of events using a series of trials.
6. represent the results of probability experiments as ratios, decimals, and percents between 0 and 1.
7. use experimental or real-world data to estimate the probability of future events.
8. determine and interpret the probability of a given event occurring in a given sample space.
9. use sampling techniques to conduct probability experiments.

SOUTH DAKOTA MATHEMATICS STANDARDS
GRADE 8

By the end of eighth grade, students understand, use, and connect a variety of techniques for solving linear equations, inequalities and systems of equations in applied contexts. They understand the meaning of variables, expressions, equations, and inequalities, and their use as models for situations. Students evaluate, graph, and interpret the graphs of a wide variety of functions, and connect the behavior of the graphs to their corresponding representations as tables, equations, and situations. Students apply proportional reasoning to solve problems involving scale drawings and similar figures, and connect geometic situations involving similarity of algebraic and numerical situations involving direct variation.

EIGHTH GRADE ALGEBRA STANDARDS

THE STUDENT WILL:

1. apply properties of equalities and inequalities using algebraic techniques.
2. use equalities and inequalities to life-related situations.
3. use properties to justify the steps to expand, combine, or simplify polynomial expressions.
4. analyze products of binomials using area models. (example: $(x + 3)(x - 2)$
5. analyze linear equations to create generalizations.
6. solve and graph equations and inequalities.
7. represent solutions to open sentences and inequalities graphically.
8. describe and represent relations from collected data using tables, graphs, and rules.
9. solve multi-step linear equations using strategies involving inverse operations and integers.
10. determine slope from a graph, ordered pairs, or an equation.
11. identify x and y intercepts from an equation or graph.
12. generalize the impact of coefficients and constants of linear equations.
13. identify various phenomena that represents different families of graphs.
14. solve word problems involving direct and inverse variation.

EIGHTH GRADE GEOMETRY STANDARDS

THE STUDENT WILL:

1. use given assumptions to determine properties of figures and relationships between figures.
2. use visual perspectives to analyze geometric problems.
3. describe, classify, and construct plane and solid figures. (example: prisms, pyramids, cylinders, and cones)
4. use the Pythagorean Theorem to solve problems.
5. use various geometric properties, formulas, and relationships to solve problems involving three-dimensional shapes.
6. use given top, side, or bottom views of objects to construct three-dimensional models.
7. construct three-dimensional figures from two-dimensional views.
8. develop two-dimensional representations that demonstrate various perspectives of three-dimensional objects.
9. determine volume and surface area of three-dimensional models.

EIGHTH GRADE MEASUREMENT STANDARDS

THE STUDENT WILL:

1. apply proportional reasoning to solve measurement problems.
2. design procedures for measuring various attributes of complex figures.
3. develop and use standard formulas for surface area and volume.
4. estimate and determine volume using standard and nonstandard units.
5. use degrees as a unit of measure for angles and circle problems.
6. develop rules to use when converting between different measurement systems.
7. use the most appropriate tool to measure volume in customary and metric systems.
8. determine precision, accuracy, and measurement errors in a variety of situations.
9. apply mathematical techniques in situations that defy direct measurement. (example: measuring the height of tree, distance to the moon)
10. solve problems involving two- and three-dimensional measurement situations in everyday contexts.
11. use volume and surface area formulas to solve problems.

EIGHTH GRADE NUMBER SENSE STANDARDS

THE STUDENT WILL:

1. represent numbers in a variety of equivalent forms. (example: radicals, absolute value)
2. describe relationships between the subsets of the real number system.
3. explain the use of irrational numbers. (example: *pi*)
4. use concrete representations of real numbers in daily situations.
5. simplify numerical expressions involving exponents.
6. use proportions to solve scale-model problems with fractions and decimals.
7. determine a relative position of a square root on a number line.
8. read, write, and compute within any subset of real numbers.
9. read, write, and explain exponential notation.
10. use estimation strategies to predict results and help solve multi-step problems involving real numbers.
11. formulate rules to solve practical problems involving real numbers.
12. use properties to justify steps when simplifying expressions.
13. create algorithms to determine solutions for equations and inequalities.
14. formulate counter-examples to disclaim given assertions.
15. explain the magnitude of radicals, numbers expressed with exponents, and the absolute values of numbers.
16. associate mathematical symbols with word names of real numbers.
17. explain the effects of operations on the magnitude of real numbers.

EIGHTH GRADE PATTERNS, RELATIONS, AND FUNCTIONS STANDARDS

THE STUDENT WILL:

1. construct problems involving dependent and independent variables.
2. represent and interpret quantitative relationships graphically.
3. understand the relationship of solutions in one variable, the x-intercept of the related linear equation in two variables, and the related situations from which each arise.

4. create rules to explain the relationship between numbers when a change in the first variable affects the second variable.
5. represent situations with patterns and relations to find exact or approximate solutions to problems.
6. investigate and describe functional relationships of geometric figures. (example: area is the function of the radius)
7. describe and represent relations using tables, graphs, and rules.
8. create and solve problems using proportions, formulas, and functions.
9. identify, describe, represent, extend, and create exponential patterns. (example: the accumulation of a unit of money (penny) over time)
10. identify the special characteristics of relationships including maximum and minimum values.
11. differentiate between continuous and discrete functions.
12. use exponential growth or decay to explore exponential functions.
13. explain the concept of limit using various representations. (example: $1 + \frac{1}{2} + \frac{1}{4} + . .$)

EIGHTH GRADE STATISTICS & PROBABILITY STANDARDS

THE STUDENT WILL:

1. explain impact of sampling bias on data and describe procedures for selecting unbiased samples.
2. create and solve problems involving the mean, median, mode and range of a set of data.
3. consider effects on reliability of sampling procedures and of missing or incorrect information.
4. use a variety of visual representations to display data to make comparisons, predictions, and inferences.
5. evaluate the validity of claims based on statistical data.
6. establish appropriate sample spaces to apply principles of probability for simple and compound chance events.
7. express theoretical probability of experimental outcomes.
8. estimate probability of simple and compound events using a series of trials.
9. explain the difference between independent and dependent events and the impact on results in specific probability situations.
10. determine and interpret the probability of a given event occurring from a given sample space.

SOUTH DAKOTA MATHEMATICS STANDARDS
GRADES 9 – 12

GRADES 9-12 ALGEBRA STANDARDS

THE STUDENT WILL:

1. select, justify, and apply a technique to solve quadratic equations over the set of complex numbers and interpret the results graphically.
2. analyze the relationships among the coefficients, factors, and roots of polynomials.
3. apply commutative, associative, distributive, identity, and inverse properties when combining functions.
4. use matrices to organize and manipulate data, including matrix addition, subtraction, and scalar multiplication.
5. analyze various expressions which emphasize the distributive property. (example: $3(x+2)$; $(x^3 - 4x^2 + 3x + 1)(x^2 - 2x + 3)$.
6. explain the logic of algebraic procedures.
7. extend the concepts of algebra to other types of functions. (example: trigonometric, exponential, and logarithmic)
8. apply recursive formulas to express iterative patterns of change including those of exponential growth and decay. (example: mortgages, investment returns)
9. determine roots of polynomial functions including complex roots.
10. determine equations for lines meeting certain conditions.
11. use inductive reasoning to test and prove that a formula is correct.
12. explore and develop procedures to identify the real roots of polynomial functions.
13. determine the solution of systems of equations in multiple ways.
14. solve problems using the quadratic formula including graphic representation and analysis.
15. analyze the binomial theorem.
16. solve linear-quadratic and quadratic-quadratic systems of equations algebraically and graphically.
17. derive procedures for determining critical features of circles, ellipses, hyperbolas, or parabolas given equations in standard form.
18. use matrices to investigate networks and graphs.
19. create algebraic models to represent problem situations.
20. compare quadratic growth with linear and exponential growth.
21. explain the graphical impact of the *xy* term in a quadratic equation.
22. graph and interpret complex numbers in vector and polar form.
23. build formulas representing patterns that are algebraic, trigonometric, logarithmic and exponential.
24. find sums, differences, scalar products, dot products, and norms of vectors noting properties which apply.
25. determine, interpret, and use a unit directional vector, perpendicular components, and norms to express vectors in the coordinate plane.

GRADES 9-12 GEOMETRY STANDARDS

THE STUDENT WILL:

1. know, use, derive formulas for, and solve problems involving perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures.
2. prove the properties of geometric figures using algebraic and deductive proofs.
3. justify conjectures pertaining to geometric figures.
4. use given information to deduce properties of and relationships between figures.
5. explore and analyze the properties of triangles.
6. investigate and identify congruence and similarity relationships among triangles.
7. determine the values of the six trigonometric functions of angles in standard position.
8. investigate and use properties of angles, arcs, chords, tangents, and secants to solve problems.
9. identify, create, and solve practical problems involving triangles and vectors.
10. build three-dimensional figures from two-dimensional shapes or drawings.
11. draw two-dimensional drawings of three-dimensional objects from various perspectives.
12. build three-dimensional objects to scale.
13. use matrices to translate, reflect, rotate, or scale polygonal figures represented on the coordinate plane.
14. use graphing tools to study transformations. (example: congruence using rigid motion, similarity using magnification of images)
15. select transformations required to map images of objects.
16. use proportions to solve problems.
17. identify, create, and solve practical problems using a system of vectors and their horizontal and vertical components.
18. represent situations using the properties of coordinate geometry to answer pertinent questions.

GRADES 9-12 MEASUREMENT STANDARDS

THE STUDENT WILL:

1. investigate and explain the relationships between linear, square, and cubic measures and describe how changes in one of the measures of an object affect the others.
2. analyze unit combinations to check answers. (example: feet per second)
3. use quotient units of measure and relate them to slope. (example: speed, density)
4. derive and use formulas for solving problems involving measurements.
5. develop units or combinations of units for a given situation or application.
6. create tools or applications processes to solve problems that defy direct measurement.
7. use the concept of significant digits in giving answers to an appropriate degree of accuracy.
8. create tools or application processes to improve accuracy or minimize error in measurement situations.
9. analyze specific measurement situations to determine necessary degree of accuracy and/or allowable error tolerance.
10. identify the structural parts and characteristics of objects to answer questions about them. (example: a penny can be seen as a cylinder with a small height so its volume is $V=\Pi r^2 h$)
11. solve measurement problems involving perimeter, area, volume, and mass of irregularly-shaped objects.

GRADES 9-12 NUMBER SENSE STANDARDS

THE STUDENT WILL:

1. describe the structure of the real number system and related subsets.
2. apply properties and axioms of the real number system to various subsets. (example: axioms of order, closure)
3. understand that real numbers can be represented in a variety of forms. (example: integers, fractions, decimals, percents, scientific notation, exponents, radicals, absolute value, logarithms)
4. describe the relationship of the real number system to the complex number system.
5. explain the meaning of the number *e*.
6. add, subtract, multiply, and divide algebraic expressions.
7. evaluate algebraic expressions.
8. add, subtract, multiply, and divide real numbers including roots and exponents using appropriate computational strategies. (example: mental mathematics, paper and pencil, calculator)
9. explain the effects of arithmetic operations on real numbers. (example: roots, exponents, and inverse relationships)
10. analyze and describe fractional exponents. (example: $10^{3/4}$)
11. analyze the decimal representation of numbers. (example: 1/3 = .33333, .010010001. . .)
12. add, subtract, multiply, divide, and simplify expressions containing fractional exponents.
13. use estimation strategies in complex situations to predict results and to check the reasonableness of results.
14. select and justify alternative strategies. (example: use properties of numbers that allow operational shortcuts for computational procedures)
15. apply properties of arithmetic and geometric sequences and series to solve problems. (example: write the first n terms, find the nth term, evaluate summation formulas)
16. use logic strategies to develop and defend mathematical arguments.
17. understand and use basic concepts of infinity and limits.
18. compare, contrast, and extend arithmetic and geometric patterns of growth and use them to make predictions about events for which there is no data.
19. understand the relative size of sets of rational numbers and irrational numbers.
20. describe impact of increasing powers on products and quotients.
21. apply operations to numbers expressed in scientific notation.

GRADES 9-12 PATTERNS, RELATIONS, AND FUNCTIONS STANDARDS

THE STUDENT WILL:

1. use various representations of functions. (example: graphs, tables, symbolic forms)
2. analyze direct and inverse relations to determine their characteristic patterns.
3. apply transformations to the graph of a basic function and predict and analyze the results.
4. determine the domain, range, zeros, y-intercepts, end behavior, relative maximum and minimum points, and symmetry of functions.
5. demonstrate and explain the effects that changing coefficients and/or constants has on the graph of a function.
6. use a graph of a function to find the graph of the inverse function.
7. determine the restrictions that must be placed on the domain and range of a relation for it to be a function.
8. create tables or graphs to interpret relations and/or functions.

9. create geometric and numerical patterns that model relations and/or functions.
10. determine which type of function best models a situation, write an equation, and use this equation to answer questions about the situation.
11. use laws of logarithms to simplify expressions and solve equations involving logarithms and exponents.
12. analyze the relationship between exponential and logarithmic functions.
13. graph various parametric polar equations.
14. identify natural phenomena that are cyclic.
15. apply special number relationships such as sequences and series to real-world problems.
16. compare, contrast, and extend arithmetic and geometric patterns of growth and use them to make predictions.
17. determine and use recursive formulas to express iterative patterns of change including those of exponential growth and decay.
18. use concepts of infinity and limits to solve problems.
19. use successive approximation techniques to solve problems.
20. apply limits of geometric series to problem situations.
21. use iteration and recursion to evaluate problem situations.
22. solve equations that include both infinite solutions and restricted domain solutions.
23. estimate the limit of a given infinite sequence.

GRADES 9-12 STATISTICS & PROBABILITY STANDARDS

1. analyze and evaluate surveys and experiments conducted by others. (example: bias, randomness, analysis, interpretation)
2. create, implement, and defend a plan for gathering data to answer relevant questions.
3. compare multiple one-variable data sets, using statistical techniques including measures of central tendency and dispersion.
4. calculate measures of central tendency and dispersion for complex sets of data.
5. demonstrate how statistical analysis can quantify variability.
6. describe the normal curve and use it to predict percentiles and probabilities.
7. use scatterplots, regression lines, and correlation coefficients to model data and support conclusions.
8. determine probabilities using counting procedures, tables, tree diagrams, and formulas for permutations and combinations.
9. determine probability of compound, complementary, independent, and dependent events.
10. evaluate effectiveness and accuracy of the model in respect to the theoretical probability.
11. design, implement, and interpret simulations to estimate probabilities of events.
12. determine probability using given graphs of distributions or table of outcomes.
13. predict outcomes of simple and compound events using given theoretical probabilities.
14. determine whether experimental or theoretical methods were used to calculate a particular probability.
15. use combinations, permutations, and probabilities to solve problems.